

March 30, 1865.

Major-General SABINE, President, in the Chair.

The Right Honourable Lord Justice Turner, and the Right Honourable the Earl of Donoughmore were admitted into the Society.

The following communications were read :—

- I. Reply to Prof. Owen's Paper "On Zoological Names of Characteristic Parts and Homological Interpretations of their Modifications and Beginnings, especially in reference to Connecting Fibres of the Brain," read before the Royal Society March 23, 1865. By W. H. FLOWER, F.R.S. Received March 28, 1865.

As the above-cited paper consists mainly of complaints of omissions and misrepresentations alleged to be contained in the abstract of my paper "On the Commissures of the Cerebral Hemispheres of the Marsupialia and Monotremata, as compared with those of the Placental Mammals" (Proceedings of Royal Society, vol. xiv. p. 71), I trust that I may be allowed a few words in reply. My first impression on hearing the paper read was a feeling of extreme surprise. When it had become necessary to give publicity to the results of observations which in some respects differed from those recorded by Prof. Owen, I was most anxious, in consequence of the natural respect which I felt for one who has laboured so long and assiduously in the field of anatomical research, that this should be done with the greatest possible deference to his opinions and feelings, and with the smallest semblance of anything which could be construed into an "attack." In this I believed that I had succeeded. That Prof. Owen should have read my "Abstract" from a point of view so different from what I had intended, is to me a source of great regret.

In the brief space allowed for the abstracts of papers communicated to the Royal Society, copious and detailed references to the writings of previous authors are necessarily out of place. Where it is usual only to give an outline of the scientific facts advanced in the paper, it would be obviously improper to follow out the labyrinths of bygone discussions on intricate questions of priority, of definitions, interpretations, and such like matters. Hence most of the citations to be found in my *paper*, not only from the writings of Prof. Owen, but also from numerous other authors, are omitted in the *abstract*. To Prof. Owen's complaints that I have not assigned to him the merit of this or that particular discovery, my reply is that I did this generally once for all in my statement that "at the outset a confirmation is afforded of the important fact, first observed by Prof. Owen, that the brains of animals of the orders Marsupialia and Monotremata present certain special and peculiar characters, by which they may be at once dis-

tinguished from those of other mammals," &c. I never thought it would be attributed to me that I wished it to be believed that every particular statement to which I did not attach the name of some other author was my own original discovery.

Little scope as there is in an abstract for entering into the literature of the subject, a reference to the writings of an anatomist who has contributed so much to advance our knowledge in the special department treated of in my paper could not be altogether omitted. I therefore found it necessary to give in a few words an epitome of the results of those writings. It is in the outline I thus gave that I am accused of serious misrepresentation.

Prof. Owen's first direct charge is contained in the following sentence:—

"It is time that the procedure be exposed and stigmatized which consists in representing the homological knowledge and opinions of an author by his definitions in a purely zoological work, *and in suppressing all reference to the descriptions* and statements in the anatomical writings of the same author, where his actual knowledge and opinions on the nature and homology of parts are given, and where alone they can be expected to be found. My present remarks refer to the published 'Abstract' of Mr. Flower's paper."

To this I reply that my first and indeed only reference in the body of my 'Abstract' is not to any purely zoological work, but to Prof. Owen's original detailed anatomical paper (Phil. Trans. 1837), to which he has himself always referred as containing the amplest exposition of his views upon the subject.

It is next objected that, in quoting what seemed to me the pith and marrow of that memoir, I omitted following passage:—

"This commissure [viz. the commissure of the hippocampi in the Marsupialia] may nevertheless be regarded as representing, besides the fornix, the rudimental commencement of the corpus callosum."

There certainly appeared to me little necessity for the formal citation of a single passage like this, which, if it can be construed into a statement that the corpus callosum is present in the marsupial animals, is perfectly inconsistent with the whole of the remainder of Prof. Owen's memoir, nay further, is immediately contradicted by the context, the whole paragraph standing thus in the original.

"This commissure may nevertheless be regarded as representing, besides the fornix, the rudimental commencement of the corpus callosum; *but this determination does not invalidate the fact* that the great commissure which unites the supraventricular masses of the hemispheres in the Beaver, and all other placentally developed Mammalia, and which exists in addition to the hippocampal commissure, is wanting in the brain of the Wombat; and as the same deficiency exists in the brain of the Great and Bush Kangaroos, the Vulpine Phalanger, the Ursine and Manges Dasyure, and the Virginian Opossum, it is most probably characteristic of the marsupial division of Mammalia." In the same page of the memoir the following occurs:—

"Meanwhile their agreement in so important a modification of the cerebral organ as the absence of a corpus callosum and septum lucidum, affords additional and strong grounds for regarding the Marsupialia as a distinct and peculiar group of mammals." Notwithstanding this clear and definite statement, which occurs again and again in some form or other throughout the memoir, we are told that it is misrepresentation to quote Prof. Owen as alleging "the absence in the marsupials of the corpus callosum." But Prof. Owen has failed to notice that the discussion of the homological relations advanced in the above cited short passage, and in similar terms in his articles in the 'Cyclopædia of Anatomy,' is by no means passed over even in my abstract, as the paragraph commencing with the following words will show.

"Can this transverse commissure, of which the relation is so disturbed by the disposition of the inner wall of the hemisphere, be regarded as homologous to the entire corpus callosum of the placental mammals? or is it, as has been suggested, to be looked upon as only representing the psalterial fibres or transverse commissure of the hippocampi?" (Proc. Roy. Soc. vol. xiv. p. 72.) If, after the words "as has been suggested," I had added "by Prof. Owen," there would, I believe, have been nothing wanting to complete as fair and full an exposition of that author's views as was compatible with the limits of an abstract.

I now regret the omission. I thought that as Prof. Owen's name occurred, both before and after, in connexion with the subject, and as no other author was mentioned, it would easily be surmised that the suggestion was his. I was moreover, as I stated before, especially anxious to avoid giving a polemical appearance to my paper by too frequent citations by name, where it was necessary to show a divergence of opinion.

I now come to the alleged misrepresentation of Prof. Owen's opinions contained in a foot-note to my abstract, which runs as follows:—

"In the paper by the same author [Prof. Owen] 'on the Characters, Principles of Division, and Primary Groups of the Class Mammalia' (Proc. Linn. Soc. 1858), the Subclass *Lyencephala* ('loose' or 'disconnected' brain), equivalent to the Marsupialia and Monotremata, are characterized as having the cerebral hemispheres but feebly and partially connected together by the 'fornix' and 'anterior commissure,' while in the rest of the class a part called 'corpus callosum' is added, which completes the connecting or commissural apparatus." It is now objected that this was only intended as a "zoological definition" or "character."

Not being aware that a zoological character, valid as such, can misrepresent an anatomical truth, when I wished to find a brief epitome of Prof. Owen's latest views upon the nature of the commissures of the marsupial brain, in corroboration of the one I had given in the text from his earliest memoir, I adopted the above statement. I adopted it, moreover, because he had himself referred to it in the following emphatic terms. I quote from the well-known "Reade Lecture," delivered before the University of Cam-

bridge in 1859 \* (p. 23) : "At length, having dissected the brain, in one species at least, of almost every genus or natural family of the mammalian class, I felt myself in a position to submit to the judgment of my fellow labourers in Zoology, at the Linnean Society in 1857, the generalized results of such dissections, comprising a fourfold primary division of the MAMMALIA based upon the four leading modifications of cerebral structure in that class.

"In some mammals the cerebral hemispheres are but feebly and partially connected together by the 'fornix' and 'anterior commissure'; in the rest of the class the part called 'corpus callosum' is added, which completes the connecting or 'commissure' apparatus.

"With the absence of this great superadded commissure is associated a remarkable modification of the mode of development of the offspring.\*\*\* This first and lowest primary group, or subclass of Mammalia, is termed, from its cerebral character, LYENCEPHALA, signifying the comparatively loose or disconnected state of the cerebral hemispheres."

I think that I should scarcely be blamed for putting my trust in an author's own description of the "generalized results" of his researches, deliberately laid before his fellow-labourers at a meeting of a learned Society twenty years after those researches were made.

I may add, moreover, that the works, both English and foreign, upon Comparative Anatomy and Physiology, in which the simple fact that the marsupials and monotremes differ from the other mammalia by the absence of a corpus callosum or great transverse commissure to their brain is stated upon the authority of Prof. Owen, may be said to comprehend most of those of any importance published since the year 1837. One or two examples will suffice. MM. Eydoux and Laurent (*Voyage de la Favorite*) have thrown into a tabular form the published results of the dissections of the brains of the Implacental Mammalia as compared with placental mammals and birds, in which Table the part played by the corpus callosum is as follows :—

" Corps calleux...	MONODELPES. existe.	DIDELPHES. manque.	ORNITHODELPES. manque.	OISEAUX. manque."
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This statement of the "résultat des observations de M. R. Owen," so far from having called forth the strictures of that anatomist, is quoted with approbation in his article "Monotremata" in the 'Cyclopædia of Anatomy and Physiology.'

In Van der Hoeven's 'Zoology,' vol. ii. p. 596 (Dr. Clark's edition), it is stated that "the great transverse commissure of the hemispheres of the cerebrum is, with the exception of the Monotremes and Marsupiates (R. Owen, 'On the Structure of the Brain in Marsupial Animals,' Phil. Trans. 1837), present in all mammals." In the preface of the same work, the editor, speaking upon the authority of the above-mentioned paper in the Journal of the Linnean Society, says, "In some mammals the cerebral

\* On the Classification and Geographical Distribution of the Mammalia, 1859.

hemispheres are only partially connected by the fornix and the anterior commissure; in the rest of the class the corpus callosum is added."

I will only cite one other instance to show that I am far from being singular in the outline I have given of the most important part of Professor Owen's researches upon this subject.

In the year 1851 the Copley Medal of this Society was awarded to Professor Owen. In the epitomized account of his labours, the observations upon the structure of the Marsupial Brain are referred to in the following terms. I quote from the President's Address (Proceedings of the Royal Society, Dec. 1st, 1851):—"In the Philosophical Transactions for 1837 appeared a memoir from Professor Owen's pen, describing certain peculiarities in the brain of the Marsupialia, *especially the absence of the corpus callosum*. The same condition he subsequently discovered in the Ornithorhynchus and Echidna. This, and other peculiarities of structure in the sanguiferous, osseous, and dental systems, led Professor Owen to suggest a modification of the classification of the mammalia which Cuvier had adopted in his last edition of the 'Règne Animal.' Deeming modifications of brain of more importance than those of ungual phalanges, and connecting the higher development of the commissural system of the brain with the longer sojourn of the fœtus in the womb, and its more intimate union therewith, Professor Owen, in his paper 'On the Classification of the Marsupials' in the Trans. Zool. Soc. 1839, groups together all the mammalia which have a placenta under any form, and which have a corpus callosum, in a primary *subclass*, under the name of Placentalia; the rest form the Subclass *Implacentalia*, and this includes the orders Marsupialia and Monotremata."

This outline of the most important results of a series of anatomical researches could not have been intended as a "zoological definition." If I have misrepresented Professor Owen in stating broadly that he alleged that the implacental mammalia were distinguished from the remainder of the class by the absence of the corpus callosum, so also did the compiler of the above paragraph; and at least one of the reasons assigned for the award of the highest honour the Society can bestow is grounded on a misconception. The main difference as to questions of fact between Professor Owen and myself may be stated briefly as follows. He has seen and described, in the brains of the implacental mammals, a transverse commissure between the hemispheres of the cerebrum, which he calls 'fornix,' 'commissure of the hippocampi,' or sometimes 'rudimental commencement of the corpus callosum.' This commissure he appears to have seen (or at all events to have described) only in a portion of its extent. He has found in placental mammals a great transverse commissure super-added to this, to which he generally restricts the term 'corpus callosum.'

I have seen and described in the brain of several implacental mammals the same transverse commissure, but have traced out its relations and connexions more fully, especially by means of transverse and lon-

gitudinal sections. If my determination is correct, it represents (not merely according to transcendental homological signification, but as a simple question of plain anatomical observation) the whole of the great transverse commissure, or corpus callosum of the lower placental mammals, only in somewhat reduced proportions, and with relations somewhat modified by the peculiar form of the inner cerebral wall.

There is consequently no superadded structure in the brain of the latter group.

To the imputation, twice repeated, of having "obtained" or "derived" the notions and ideas contained in my paper from Professor Owen's writings, no direct reply is necessary. The communication which I presented to the Society is the result of repeated original observations and dissections, made at various periods, extending over more than three years. The descriptions are all verified by drawings and preparations.

That their publication (if they should be so honoured) may advance in some slight degree our knowledge of a difficult and obscure, yet important branch of anatomy, is all that I venture to hope. That they are entirely free from errors, or that they may not, at some future time, be superseded by the researches of abler investigators, I do not presume to believe.

## II. "On the Size of Pins for connecting Flat Links in the Chains of Suspension Bridges." By Sir CHARLES FOX. Communicated by the President. Received March 2, 1865.

In the construction of chains of this kind, it is of the highest importance that the pins, which pass through and connect together the links of which the chains are composed, should be of the right size, inasmuch as their being too small, as compared with the links through which they pass, renders ineffective a portion of the iron contained in the latter, which then exists only as a useless load to be carried by such links; while at the same time, if the pins and heads of the links be too large, they become uselessly cumbersome and expensive.

Careful examination and experiments made upon a large scale (which will be explained hereafter) have brought out facts by which a simple rule has been arrived at—a rule that may safely be adopted as a guide in deciding upon the relative sizes of these two parts.

On this rule mainly depends the economical use of iron in the construction of such chains.

In this paper the term chains for suspension bridges implies such as are usually employed, and are composed of several flat bars of equal thickness throughout, placed side by side, but having their ends swelled edgeways so as to form what are technically termed heads, and which are coupled together by pins passing through holes in such heads, as shown in figs. 5 & 6 in the accompanying drawing.

In deciding upon the size of the pins, it has often been assumed, as